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A COMPREHENSIVE STUDY OF THE TOCKS ISLAND LAKE PROJECT AND ALTE--ETC(U)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The purpose of this study is to help decision makers determine future water resource needs of the Delaware River Basin area and ways of meeting these needs. This report, undertaken in 1975, for the U.S. Army Corps of Engineers by a consultant firm is a summary of the demands placed upon the water resources of the Basin and investigation of the alternatives proposed to meet or modify these demands. The water supply needs, outdoor recreation demands, salinity intrusion conditions, flood control needs and both		

present and future electric power generating capacity are briefly described. An evaluation of the proposed Tocks Island Project and alternative programs includes a summary of direct costs and benefits, land use goals, primary and secondary local economic impacts, public infrastructure impacts, local social impacts etc.

This summary review (only) describes significant points of the findings of the consultant. For a more complete analysis, the 5 appendixes of this report should be studied.

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Summary
OF A COMPREHENSIVE STUDY OF THE
Tocks Island Lake
Project & Alternatives
JULY 1975

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URS/MADIGAN-PRAEGER, INC.
150 EAST 42nd STREET
NEW YORK, N.Y. 10017, (212) 953-8600

CONKLIN & ROSSANT
251 PARK AVENUE SOUTH
NEW YORK, N.Y. 10010, (212) 777-2120

Summary Review

*The purpose of this study is to help decision makers determine future water resource needs of the Delaware River Basin area and ways of meeting these needs. To do this, demands to be placed upon the water resources of the Basin were analyzed, alternatives available to meet or modify them were investigated, and impacts of the Tocks Island Lake Project and alternatives to it were identified and assessed. This document summarizes the study effort and output. **This Summary Review section only presents significant points to help in providing a realistic, overall perspective.***

Because a summary of a major study must involve selections among diverse aspects, the complete reading of this document and reference to the full report is strongly recommended. For ease of reference, a complete and detailed table of contents is included in the Part A volume.

MAJOR FINDINGS

During the next 50 years needs to be met by resources of the Delaware River Basin will exist in the areas of water supply, flood control, recreation and electric power. Either the Tocks Project or alternatives to it can meet a substantial portion of these needs.

- The multi-purpose nature and large scale of the Tocks Project makes it more cost effective than alternatives, but the combination and concentration of purposes produce some highly adverse impacts on transportation, other public facilities and services, land uses, and the environment in portions of the region.
- Technically viable alternatives to the Tocks Island Project do exist, although relative costs, benefits, impacts and the degree to which each satisfies area needs vary widely. Questions regarding the institutional and political viability of some must also be resolved.
- Water supply alternatives generally have somewhat higher costs per unit of yield than the Tocks Project and lesser but still significant adverse impacts.
- Flood control alternatives may involve non-structural measures which reduce or recompense flood damage rather than prevent the occurrence of floods. This approach is desirable but dependent upon local cooperation and the effective implementation of flood plain management techniques.
- Recreation alternatives involve the dispersal of parks and many of their associated impacts in rural, suburban and urban areas. Their costs and benefits are roughly comparable to those of the Tocks Projects.
- Electric power alternatives are also based upon the dispersal of power generating facilities. Annual electric power costs are somewhat higher than for the Tocks Project; benefits are similar.

Regional planning studies indicate that because of the continued absence of land use controls in portions of the region, the combination of a return to normal economic conditions and a nearly completed Interstate highway network will have a substantially greater adverse impact on development patterns and present lifestyles in the Delaware Basin area than will the proposed Tocks Project or alternatives.

The development of a regional recreation facility such as the Delaware Water Gap National Recreation Area will place inordinate burdens upon the public services of nearby townships. The provision of "impact" funds and planning assistance will thus be essential. Programs to provide such funds, however, are limited.

Other major findings of the study affecting water resource needs and allocations are:

- The probability of significant salinity intrusion into the Philadelphia and Camden water supply systems is very low. Additional low flow augmentation to control salinity intrusion, based upon projections of likely consumptive use and presently authorized diversions, does not appear to be required.
- The 1954 Supreme Court Decree and the Delaware River Basin Compact will continue to govern the disposition of the Basin's water resources. Changes must therefore be consistent with their provisions or be agreed to by all signatory parties.

MAJOR CONCERNS AND ISSUES

Major concerns and issues were assessed considering the foregoing and related findings. For each of the major concerns the relationship of alternative positions on these issues to the Tocks Project decision is indicated below.

- While numerous water supply sources can be developed to meet future needs of areas served by water resources of the Delaware Basin, cost, environmental, planning and political considerations have often prevented their development for Northern New Jersey.

If commitments are made to fund and implement water supply sources for Northern New Jersey within the context of a master plan which is acceptable to concerned groups and decision makers, then the need for the Tocks Project could be significantly reduced. If these commitments can not now be made, the need for a major project such as Tocks would be increased.

- Levels of various impacts on the Delaware Basin region due to normal growth will be substantial whether or not Tocks is built. Additional impacts and public service requirements (especially for highways) in the seven nearby counties attributable to the Delaware Water Gap National Recreation Area with a high visitation level would also be significant. These additional impacts must be considered against the Project's benefits and the scale of assistance required by local governments to cope with them.

If such assistance is not forthcoming, or if these additional impacts are deemed unacceptably high, then a large scale regional solution such as the Tocks Project would be inappropriate to meet area-wide needs.

- The use of non-structural flood protection measures have proven their efficacy when there is a high degree of public acceptance and local cooperation and implementation.

If it is considered likely that existing Federal and state flood control legislation will be substantially implemented, the need for major structural flood protection measures such as the Tocks Project would be reduced.

- While the proposed Tocks Island Lake will be eutrophic, this is not expected to affect water supply, flood control, and electric power uses. The quality of some recreation experiences in portions of the lake will be lessened though overall patronage will not be reduced. The need to implement Upper Delaware Basin water pollution control measures may be somewhat accelerated by the presence of the Tocks Island Lake. The timetable for treatment facilities, which are not of inordinate cost and which will eventually be required in any case, may have to be advanced. A program to curtail the non-point pollutants would be relatively inexpensive, but no public program now exists for reducing private sector costs.

These effects are not of major significance with respect to a Tocks decision.

- The financing of alternative flood control and recreation facilities may be realized via local, state or Federal allocations and programs and the funding of water supply projects may be accomplished by private, local or state funds.

To the extent that other types of funds are not available or committed, Federally authorized and financed projects such as Tocks could be advantageous to meet certain area-wide water supply, flood control and recreation needs.

- The Tocks Project may make the Lower Delaware Basin more attractive to some heavy water using industries, such as electric power facilities, because it will decrease the need for those industries to provide releases of water or take alternative measures with respect to low-flow river conditions.

If this is considered important and worthy of public support, then the Tocks Project would offer advantages in this regard.

A sound decision regarding the Tocks Project must be based upon current assessments of future impacts, future needs, and likely future levels of implementation of various government programs such as those noted above. The weighing of these assessments together with the nature and degree of shorter term project costs, benefits and impacts provides much of the basis for the necessary judgement. Continued indecision will adversely affect needed present and future programs in such areas as non-structural flood protection, water supply, pollution control, regional and local planning, and land use controls.

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The determination of an appropriate course of action regarding the Tocks Project depends upon: (1) the identification and description of pertinent facts, issues and impacts; (2) the values or measures of importance placed on this information; and (3) evaluations and "trade-offs" leading to overall assessments of merit for various options. This report provides basic information to fulfill these steps so that recommendations regarding the disposition of the Tocks Project can then be made.

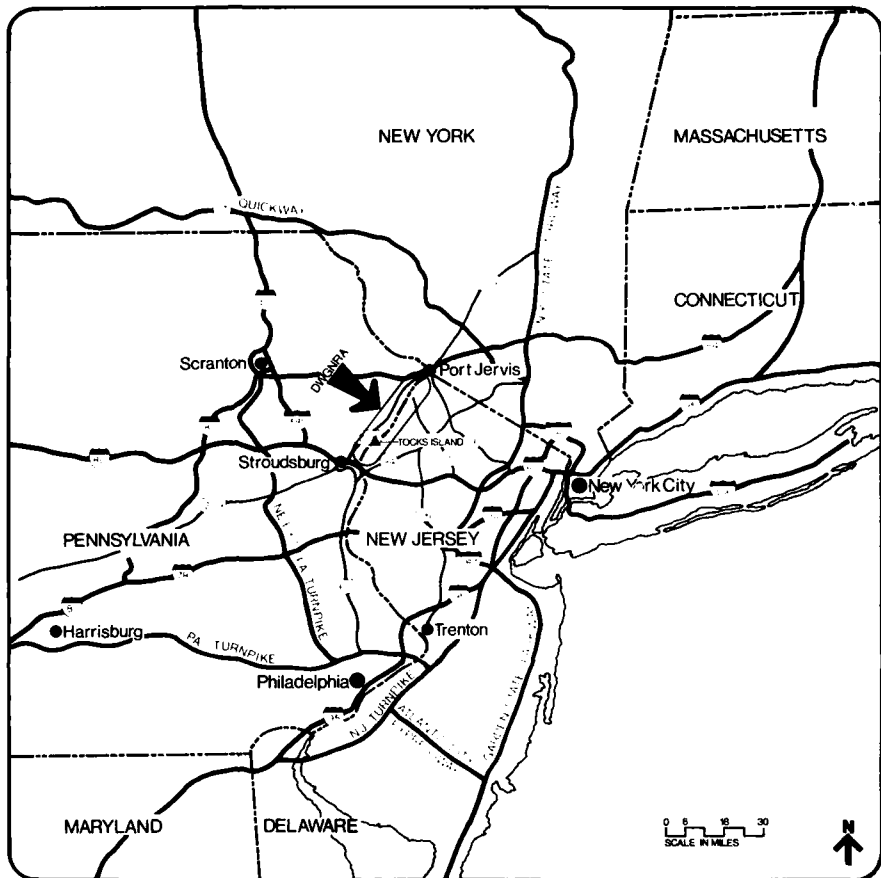
Background

The Delaware River is one of the Northeast's major natural scenic and water resources. From early colonial days the River's water potential was recognized with the building of the municipal water works at Bethlehem and Philadelphia in the 1770's. During the middle of the twentieth century, New York City built reservoirs on the Delaware River headwaters to assure its future water supplies.

Two recent natural events have emphasized the need for the further study of the water resources of the Delaware River Basin. Severe flooding due to two tropical storms occurred in August 1955 and drought conditions prevailed during the early and middle 1960's. After the floods of the mid 50's, Congress authorized the Corps of Engineers to undertake a comprehensive study of the Basin's water resources (House Document 522, 87th Congress, Second Session). This was completed in 1960.

The study recommended six new dams. Tocks Island, by far the largest of these, was authorized by Congress in the Flood Control Act of 1962. The project consists of an earthfill dam on the main stem of the Delaware River approximately five miles northeast of Stroudsburg, Pennsylvania and an impounded reservoir reaching 37 miles upstream to Matamoras, Pennsylvania and Port Jervis, New York. The impoundment is to provide storage for water supply, recreation and hydroelectric power and additional capacity for flood control. Later, Congress authorized the Delaware Water Gap National Recreation Area to be developed in conjunction with the reservoir and also expanded the original authorization to permit the construction of the Kittatinny Mountain pumped storage facility by private electric utilities. In this study, Tocks Project references generally include these later authorizations also. The following figure locates the Tocks Island Lake Project (TILP) and the Delaware Water Gap National Recreation Area (DWGNRA) within the region.

Funds for land acquisition were first appropriated in 1968. Since that time about 67 percent of the project's land has been acquired and the Corps has continued its project planning. The final Environmental Impact Statement for the project was filed on October 2, 1971; a supplement is currently being prepared.



REGIONAL LOCATION MAP
OF TILP AND DWGNRA

Over the last several years many concerns have been expressed with respect to the project. These have generally involved environmental issues and the impact of the project on its surrounding area. Alternatives to Tocks Island have been suggested by various public and private groups and by individuals. Last summer, while Congress was considering the appropriations for Fiscal Year 1975 (H. Rpt. No. 93-1274, 93rd Congress, 2nd Session, 8 August 1974), they recognized this continuing controversy and directed the Corps, in cooperation with the Delaware River Basin Commission, to have prepared a comprehensive and impartial review of the project and its alternatives and to make recommendations regarding the disposition of the project within one year. This is that review study.

Purpose of the Study

The following passage summarizes concerns which led to the undertaking of this study.

... We lack, however, a comprehensive policy study which objectively surveys the needs of the region and goes from that to identify alternative methods to meet those needs and assesses (the) environmental, social and economic impacts of these alternatives. We need studies which answer the specific questions of the Governors of the four Basin States and which could guide them to broad conclusions in their recommendations and requests to the Congress; policy decisions on whether to proceed now with the dam project ... whether to delay the dam project until some future date and meanwhile, acquire and hold the necessary land ... or whether to deauthorize the project and meet the needs in the region by means of some alternative or set of alternatives; (these) are the kinds of issues which confront the Congress and on which they have asked definitive recommendations from the four governors ...

David Bardin, Commissioner
New Jersey Department of
Environmental Protection

The purpose of this "Comprehensive Review Study of the Tocks Island Lake Project and Alternatives" is thus to analyze the water and related demands to be placed upon the resources of the Basin, to investigate the alternative strategies available to meet or modify them, and to identify impacts of the Project and alternatives to it. The study provides the information, analyses, evaluations and perspectives required by the Delaware River Basin States and the Corps of Engineers for them to recommend to the Congress whether the Tocks Island Lake Project should proceed to construction at this time, be modified, be deferred, or be deauthorized. This study does not make recommendations but rather provides the information for all interested parties to assess and form judgements and for appropriate governmental bodies and officials to make recommendations to the Congress.

Study Process

This study has involved a high level of public participation and direct interaction with concerned public agencies. At periodic meetings with the Consultant, a Study Management Team monitored progress and provided comments. Citizen advisory groups to state governors were also established and meetings were regularly held between them and the Consultant and information exchanged.

Drafts of each of the study's five parts were distributed to a wide variety of interest groups, government agencies, and individuals for review and comment. After review periods, public meetings were held and all comments were evaluated by the Consultant and reflected, where appropriate, in the final text. Repositories were established throughout the Study Area for public scrutiny of documents related to the study, including study drafts. In addition, the files of the Consultant were available to the public throughout the study.

The Consultant's objective has been to make study approaches, procedures and findings known at the earliest possible time during the study period; solicit all relevant comments and opinions; and perform all aspects of the work in as public a manner as possible.

The Consultant feels that this study process was valuable. The public nature of the study was an essential ingredient and sharpened the Consultant's awareness of many issues.

Study Scope

The main text of the study is organized into five parts:

Analysis of Service Areas and Resource Needs (Part A)

To analyze the water and related demands to be placed upon the resources of the Basin and alternative strategies available to meet or modify these demands, water supply, flood control, outdoor recreation and electric power needs were assessed in defined service areas. For each of these service areas existing and programmed resource developments were fully described and became the basis for estimating the unsatisfied demand or need under three alternative growth conditions. High growth projections were based on maximizing sound economic development; medium growth estimates on essentially continuing present economic trends; and low growth forecasts on the use of policies to limit development potentials. In addition, demand reduction techniques and their relationship to these projections were analyzed along with water quality considerations.

Review of Tocks Island Lake Project (Part B)

Included was a technical review of the Tocks Project's engineering and planning with an examination of the adequacy of all steps undertaken, such as economic analyses, water quality effects, and the assessment of primary and secondary impacts. A review of criticisms and concerns of the project was also performed.

Analysis of Alternatives to Supply Resource Needs (Part C)

In order to fully judge the Tocks Project, a full range of technical alternatives, both structural (physical) and non-structural (regulatory), providing both the same, greater or lesser levels of benefits was evaluated. Alternative combinations of both single purpose and multipurpose projects were formulated and the full range of relative impacts and costs was analyzed.

Institutional Alternatives (Part D)

As water usage within the Delaware Basin is governed by the Supreme Court Decree of 1954 and the Delaware River Basin Compact, an examination of the possible re-opening of the Decree was undertaken along with the investigation of other institutional alternatives, including project deferral and deauthorization and the development of a national recreation area without a lake.

Land Use and Secondary Effect of Tocks Island Lake Project (Part E)

The impact analyses of the Tocks Project were further extended to include the full range of significant secondary impacts. These included land use, environmental, economic, public service, institutional, social and life style, transportation and growth management issues. These were identified, studied and quantified where possible.

Resource Needs

WATER SUPPLY

- (The water supply service area consists of the Delaware River Basin plus subareas in Northern New Jersey and Southeastern New York State which are now served or which may reasonably be expected to be served in the future by water from the Delaware River Basin. Diversions of 100 million gallons per day (MGD) from the Delaware Basin to the Northern New Jersey Subarea are presently authorized and an additional 300 MGD has been requested. The Southeastern New York Subarea is authorized to divert up to 800 MGD from Basin sources.
- (Within the Basin gross consumptive use is projected to double from current levels to about 600 MGD. This growth will decrease Delaware River flows and require the assessment, discussed subsequently, of salinity intrusion.
- (Estimates of public water supply needs (future demand less present and programmed supplies) in the Northern New Jersey Subarea in the year 2025 range from about 300 MGD to 800 MGD, depending upon the economic growth level achieved. Water supply needs in the Southeastern New York Subarea in the year 2025 are estimated to range from about 800 MGD to 1,500 MGD. (These estimates are extremely sensitive to changes in the substantial amounts of industrial water required in the future and specifically to that portion which will be supplied by the industries themselves rather than through public water supply systems.)

Future water supply needs may be lowered by both permanent and emergency demand reduction measures. Such reductions could amount to about 50 to 60 MGD for the Northern New Jersey Subarea. It is also possible to estimate water supply project yields to provide only for a drought which might occur about once every hundred years rather than for a more severe drought recurring every several hundred years as is now done. If this were accepted, roughly another 50 to 60 MGD could be added to the total calculated water supply yield available to the New Jersey Subarea over the forecast period. This additional yield value would reduce future water supply project and cost requirements. However, the use of this increase in yield would also mean that emergency measures, such as the rationing employed during the drought of the 1960's, would have to be used more frequently. In any case, as it is not possible to ascertain the ultimate severity of a drought beforehand, emergency measures would have to be employed more often than the drought frequency planned for.

(For the Southeastern New York Subarea, future unsatisfied demand will be largely met through the increased use of water imported from sources outside the Subarea.)
(Since it is unlikely that the authorized diversions for the New York City System from the Delaware River Basin will be either increased or reduced, the future needs of this Subarea will probably not be met from water resources of the Delaware River Basin.)

For these reasons Northern New Jersey is the primary out-of-basin area whose future water supply needs must be considered in the planning of Delaware River Basin resource development. Future needs of the Northern New Jersey Subarea must be met from a range of potential water supply projects either within the Subarea or out of the Subarea (exclusive of Tocks) or from the Tocks Island Lake Project. The combined yields of potential water supply projects in each of the foregoing categories, and the approximate capital cost per MGD of developing these yields, are:

	Approx. Yield (MGD)	Approx. Capital Cost per MGD (\$1,000.)
Northern New Jersey Subarea projects	700.	586.
Out-of-Subarea Projects	1,000.	1,300.
Tocks Island Lake Project		
—Exclusive of Low Flow Augmentation Yield	300.	580.
—Including Low Flow Augmentation Yield	over 300.	280.*

*Minimum value based on 633 MGD yield.

Using these costs per MGD of yield, the order of magnitude of the total capital costs required to meet the Northern New Jersey Subarea's water supply needs in the year 2025 for various combinations of sources under the three economic growth conditions can be approximated. Since the development of all the Subarea sources is unlikely due to the controversial nature of some of the projects, total capital costs were estimated for two cases. The first assumed 50 percent of the Subarea's potential yield as actually developed, the second assumed 100 percent.

These cost estimates show that even if most of the potential yield of the Subarea's proposed water supply sources were developed, under high growth conditions direct water supply costs could be reduced by the development of the Tocks Project together with subarea and some other out-of-subarea sources. This is based upon a range of assumptions such as that regarding the future supply of industrial water (cooling water self-supplied, process and sanitary water publicly supplied).

(If low growth economic conditions are to be planned for or realized, then the development of about half the total yield obtainable from Northern New Jersey Subarea sources could be sufficient to meet water supply needs of the Northern New Jersey Subarea through the 50-year forecast period.) If it is undesirable for any reason to implement the necessary Subarea water supply projects, then development of the Tocks Island Lake Project or other out-of-subarea sources would be required.

Also pertinent are the various sources of capital funds for different types or categories of water supply sources. Projects in the subarea and out-of-subarea categories would generally be financed by municipal, county, state or Federal government agencies or by authorities or private companies. Water supply components of the Tocks Island Lake Project would be Federally financed with charges levied against water users after a period of years to repay with interest the project costs allocated to water supply.

SALINITY INTRUSION

Another need to be met by the water resources of the Delaware River Basin is the maintenance of both the Philadelphia water supply system intake in the Delaware River and the Camden aquifer essentially free from saline intrusion. Extensive analyses performed in the course of this study indicate that salinity intrusion into the Philadelphia and Camden water systems has a very small probability of occurrence even under conditions of diversion and high consumptive use from the Basin which could be expected in 2025. The review of such probabilities is appropriate as the amount and distribution of projected depletive uses becomes better known over time. Actions related to salinity protection should be considered against the extent of potential hardships and damages which could result from such saline intrusion.

FLOOD CONTROL

(The need for flood control and flood damage reduction are measured by potential damages) of both a tangible and intangible nature. The former include physical damages attributable to inundation, flood fighting costs, and business and financial losses resulting from flood-caused disruption of normal activities. Intangible damages may include safety considerations and other concerns of people affecting their perceived well-being and individual and business plans.

Tangible damages are indicated by estimates of: prior or possible flood damage; the translation of such values into equivalent average annual damages based on flood return intervals; acreage or areas inundated; and the number and types of properties and structures involved.

(The flood of August 1955 caused an estimated \$104,716,000 in damages) (1955 dollars) throughout the Delaware River Basin, including \$22,766,900 in the eight major damage centers along the main stem between Belvidere and Burlington, New Jersey. Approximately 5,000 acres were inundated in the Basin, including 2,000 in the above damage centers. Commercial and industrial structures totaling over 1,200 in the Basin were also flooded. Considering the factors noted previously and the status of present development, average annual damages currently for the Delaware River flood plain above the Tocks Island site are estimated (in 1975 dollars) to be \$577,900 and for below the site, \$3,945,000.

(Future average annual damages or flood exposure are dependent upon projected land use in the Delaware River flood plain.) This in turn is dependent upon passage of proposed flood plain legislation in Pennsylvania and the extent to which existing flood plain legislation is enforced in New Jersey. The Federal Flood Disaster Protection Act of 1973 and the Federal Water Resources Development Act of 1974 will also play major roles in affecting and limiting the future growth in the flood plain.

In spite of the foregoing, and while development in the flood plain will not proceed as fast as growth in surrounding areas, it is likely that growth in the flood plain will still occur. Estimates of average annual damages and related impacts may thus increase. This development is relatively independent of economic growth rates but quite sensitive to the degree of implementation of non-structural flood protection measures.

OUTDOOR RECREATION

Outdoor recreation as a "commodity" does not have a fixed measurable output and is, in economic terms, highly substitutable. That is, a person may enjoy and seek out one recreational pursuit but not necessarily be considered deprived if it is unavailable and another recreational activity is engaged in instead.

The need generally to travel to a recreational opportunity and thus have the attractiveness and use of the facility significantly dependent upon its location and accessibility is another factor affecting the demand, supply and use of recreational facilities. Recreation demand and use are also clearly dependent upon a range of subjective or non-quantitative factors such as personal motives and desires.

Considering these and related factors such as trends in population, leisure time, personal mobility, income levels, recreation preferences and participation rates and the existing and programmed supply of outdoor recreation facilities, future outdoor recreation needs were projected.



(An assessment of the needs in relationship to existing opportunities indicates that:

- There is a growing popularity for rustic recreational activities such as hiking and camping, even though state forests and underdeveloped park areas are less than fully utilized, often because of their relative inaccessibility.
- Swimming is the most popular outdoor recreational activity and is likely to remain so. It is also the one with the greatest indicated need.
- Freshwater boating is restricted by the size of existing facilities and horsepower limitations, and this activity often conflicts with swimming.



(Considering these specific findings on recreational activities, the most significant factor affecting the evaluation of alternatives is that there is a substantial unsatisfied demand or need for all recreational facilities, particularly in the urban centers of the recreation service area. This need is projected to increase significantly after the mid-1980's. As the demand levels are so high relative to existing supply, they are relatively independent of the alternative growth strategies) postulated.

ELECTRIC POWER

(Peaking power is electric power generating capacity designed to supplement normal or base power facilities during peak demand hours so that the overall system may be operated more efficiently and economically.) The range of probable future peaking power demand in the electric power service area was evaluated considering the potential effect of future population growth; ranges of economic growth; personal income growth; peak demand price increases; political, environmental and other constraints relating to the future power supply; the potential electrification of end uses which presently utilize fossil fuels; and various conservation measures.

The probable high and probable low values for peak power demand in the year 2000 are estimated to be 138,500 Megawatts (MWe) and 65,600 MWe, respectively. The 1974 demand, in comparison, was 31,900 MWe. While the compounding of a large number of uncertainties makes it inappropriate to project these values beyond the mid-point of the total forecast period, it is anticipated that the demand for peak electric power will continue to increase.

Two power plant resource mix options were evaluated. One is based upon the assumption that most of the new power generation capacity added between 1975 and 2000 would be nuclear, while the other option assumes that a nuclear slowdown will occur and much of the new power generation capacity would be non-nuclear. Both consider advanced energy conversion alternatives and the research and development status and expected commercial availability of the advanced technologies.

Major factors affecting the evaluations performed are:

- (Future power demand, both base and peak load, will be influenced by a series of causal factors which are not represented in past demand levels; projections of future demand must, therefore, be analyzed essentially independently of past trends.)
- It is generally within the power of Federal and state legislators and regulators to set constraints and standards which will substantially affect both the composition of future power resource mixes and demand levels.

(Considering the foregoing and other factors noted, it is estimated that additional electric peaking power substantially in excess of that provided by the proposed pumped storage component of the overall Tocks Project will be required under all of the conditions examined in the electric power service area within the forecast period.) This need will probably develop during the 1980's or, under one set of conditions, during the 1990's.

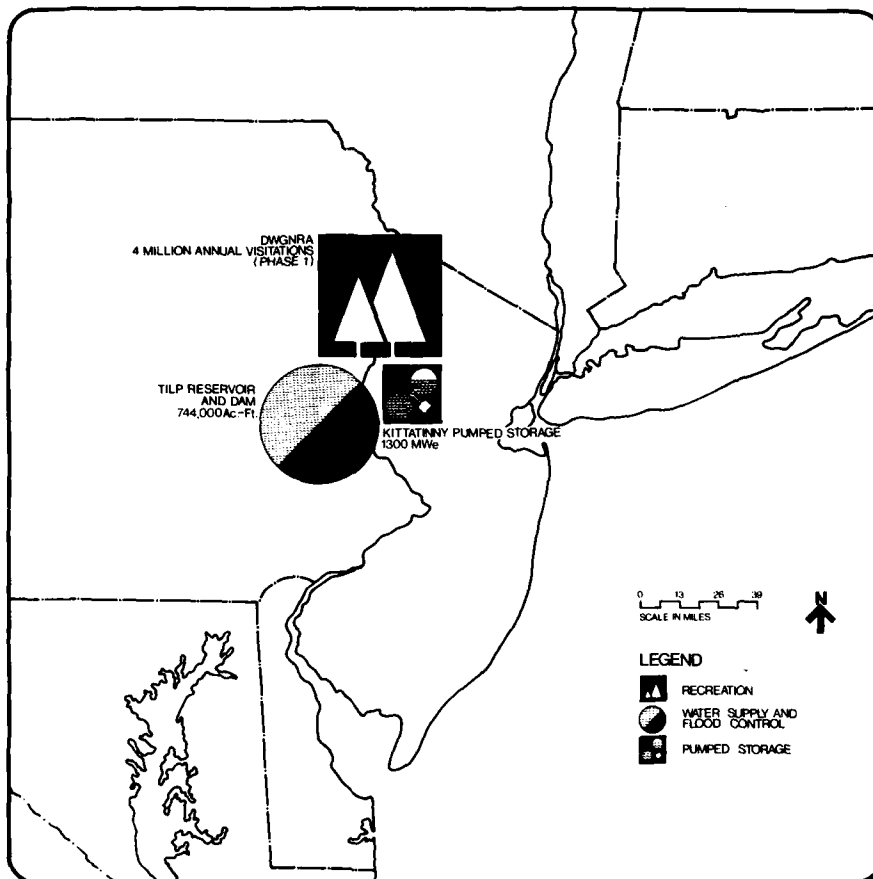
Evaluation of TILP and Alternative Programs

The Tocks Project consists of a multi-purpose dam across the main stem of the Delaware River five miles north of the Delaware Water Gap at Tocks Island and a 12,000 acre reservoir extending northward to Port Jervis, New York.

The Tocks Island Lake Project is intended to fulfill water supply purposes through the creation of the reservoir; flood control objectives by flood storage behind the dam; electric power needs by means of the Kittatinny pumped storage facility; and recreation goals through both lake-oriented activities included in TILP and the incorporation of the *Delaware Water Gap National Recreation Area* into the overall project.

Viable technical alternatives in the areas of water supply, recreation, electric peaking power and flood control were identified and appraised and alternative programs suitable for the evaluation of the Tocks Project were developed. These programs are combinations of viable technical alternatives from each of the four functional areas. The following major steps were undertaken in the selection of technical alternatives and the development of alternative programs.

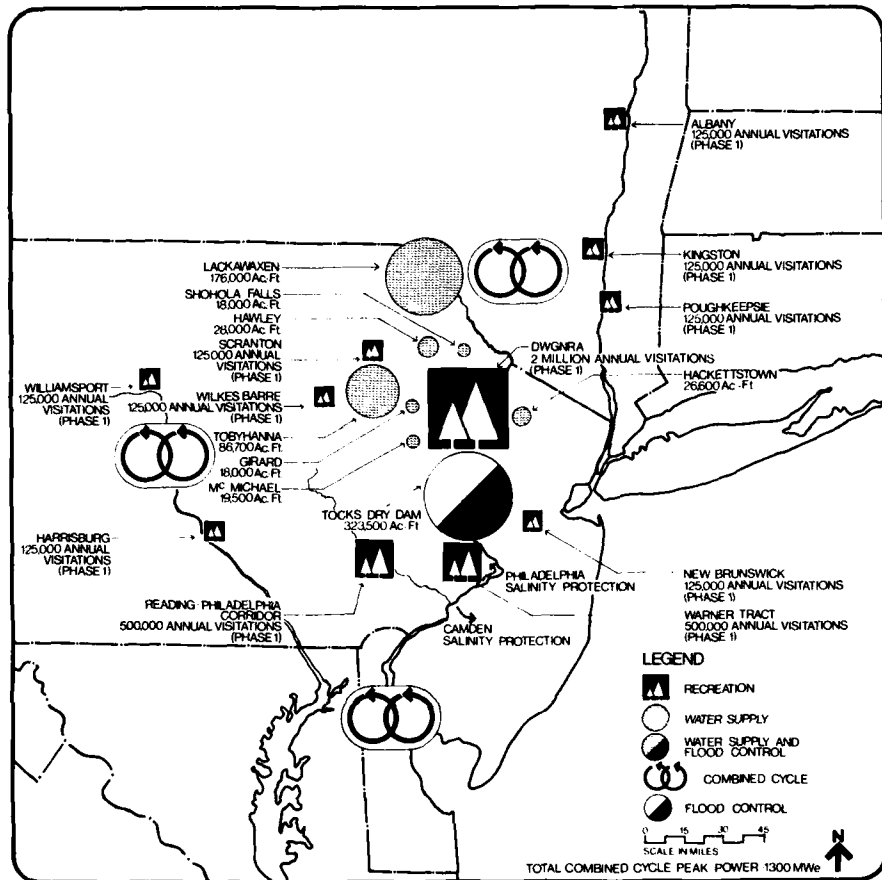
- Identification and review of the full range of possible technical alternatives in each of the four functional or "authorized purpose" areas.
- Preliminary evaluation of all of the foregoing alternatives and the discarding of those which were clearly technically unsuitable or of doubtful effectiveness.
- Detailed evaluation of the remaining alternatives with respect to their technical feasibility and cost, general benefits, and overall impacts.
- Formulation of alternative programs which can provide an appropriate comparative evaluation for the Tocks Island Lake Project.



TILP

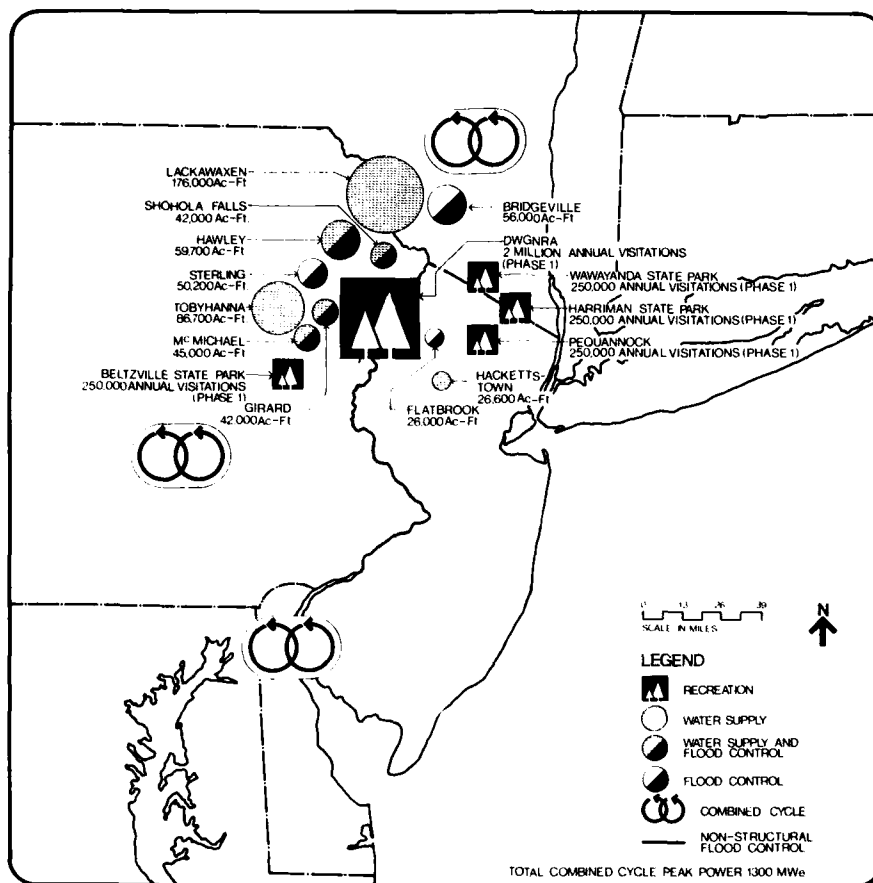
The alternative programs which are described subsequently are consistent with a range of broad policy viewpoints that may be utilized as the basis for evaluating the Tocks Project. These viewpoints relate to desired output and cost levels; economic growth levels; and the degree of emphasis to be placed upon environmental conservation concerns.

It is to be emphasized that the alternative programs are only intended to provide the basis for a comprehensive evaluation for present study purposes of the Tocks Project under a range of economic conditions and policy viewpoints. While these are examples of sound, technically viable alternatives, they are not proposals or recommendations.



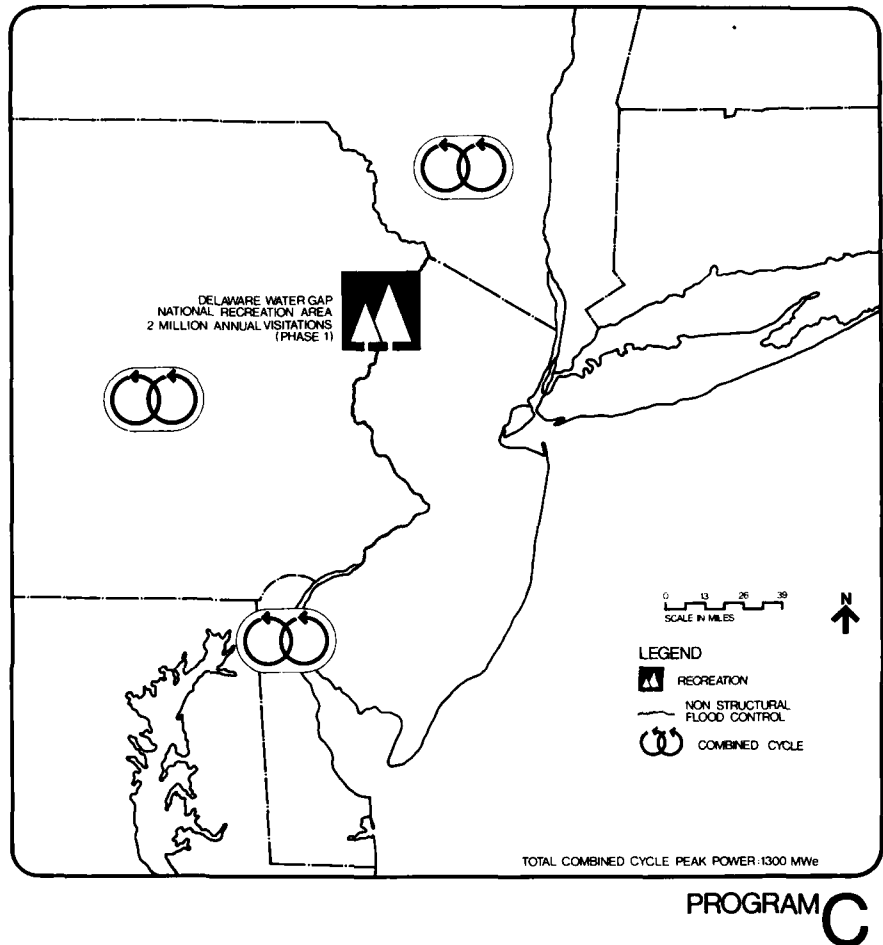
PROGRAM **A**

Alternative Program A represents technical alternatives which could be selected by policy makers intent upon providing an output roughly consistent with high growth economic conditions. As shown schematically on the accompanying exhibit, it consists of combined cycle electric power units at various locations throughout the service area; reservoirs on tributaries of the Delaware River for water supply; the temporary protection of the Philadelphia/Camden water supply system by relocating the Philadelphia intake and providing an alternative source for Camden; the construction of a limited number of new state parks for recreation, in addition to the National Recreation Area without the Tocks Island Lake; and, for flood control, the construction of a "dry dam" on the main stem of the Delaware River.



PROGRAM B

Alternative Program B is composed of technical alternatives which could be generally consistent with an intermediate level of economic growth. Combined cycle units furnish peak electric power in this program also; reservoirs on the Delaware River tributaries are proposed as water supply sources; the opening of closed reservoirs, the greater use of existing recreational facilities and the National Recreation Area without a lake are included as the recreational alternative; and flood control dams on tributaries and various non-structural flood protection measures are proposed for overall flood protection purposes.



Alternative Program C consists of technical alternatives which would be desirable from each of several viewpoints. These include minimizing costs, being compatible with a low economic growth policy, and consistency with environmental conservation concerns. For electric power, combined cycle units are again proposed; for recreation, no public programs other than the DWGNRA without the lake are proposed; and a full range of non-structural flood control measures are included for flood control purposes.

No specific water supply alternatives to the 300 MGD output of TILP are included since the forecasted need under low growth conditions is substantially less than the yield which could be developed from already proposed or potential water supply projects.

The Tocks Island Lake Project, including Phase I of the Delaware Water Gap National Recreation Area, and the three foregoing alternative programs were evaluated under each of the following seven broad evaluation category headings:

- Satisfaction of Area Needs
- Direct Costs and Benefits
- Land Use Goals
- Primary and Secondary Economic Impacts
- Environmental Impacts
- Public Infrastructure Impacts
- Social and Institutional Impacts

The accompanying exhibits list specific evaluation criteria or factors within each category and the performance of each alternative with respect to each factor is noted graphically. Positive or beneficial impacts are indicated by the location of the "floating box" in the top half of each square and adverse or negative impacts are indicated by the location of the "floating box" in the lower or shaded portion of the square. The comparative performance with respect to a single evaluation factor is indicated by the relative heights of the "floating boxes" in the squares opposite that factor. The major considerations in the determinations of relative performance are noted within the boxes.

There is, unavoidably, a substantial amount of judgement involved in these determinations and there are valid bases for differences of opinion regarding them. The information is presented so that differing evaluations of performance can be readily made within the format of the accompanying exhibits.

Judgements regarding the relative merits and impacts and overall performance of the Tocks Project are also dependent upon the values and priorities assigned to each of the broad evaluation categories as well as to each of the specific factors within the categories. These judgements can be highly subjective. Since it is the formulation of these judgements which must form the bases for the decision-making process, it is the purpose of this study to supply the necessary information and perspective in a framework which will facilitate this process.

SATISFACTION OF AREA NEEDS

Water Supply

The yields provided by Programs A, B, C and TILP are compared to year 2025 public water supply needs in the Northern New Jersey Subarea under various growth conditions in the accompanying exhibit. The yield of TILP may be increased beyond 300 MGD if low-flow augmentation provisions (shown by our analyses not to be required to protect the Philadelphia/Camden water supply systems from salinity intrusion) are not included to the degree proposed under TILP. The "other sources" referred to include Northern New Jersey Subarea projects and out-of-subarea projects.

Flood Control

The Tocks Project and the dry dam included in Program A are structural measures which would protect about 60 percent of the property subject to flood damage. Utilizing non-structural measures, either alone in Program C or in combination with structural measures in Program B, the higher levels of flood damage protection noted may be achieved. The efficacy of non-structural measures is dependent upon the substantial implementation at both state and local levels of diverse types of flood plain management regulations. Non-structural measures differ from structural measures in that they do not attempt to prevent flooding but rather provide compensation or reduce the damages incurred. Non-structural measures which have been already implemented or which are likely to be implemented are considered to be part of the base conditions for the foregoing comparisons.

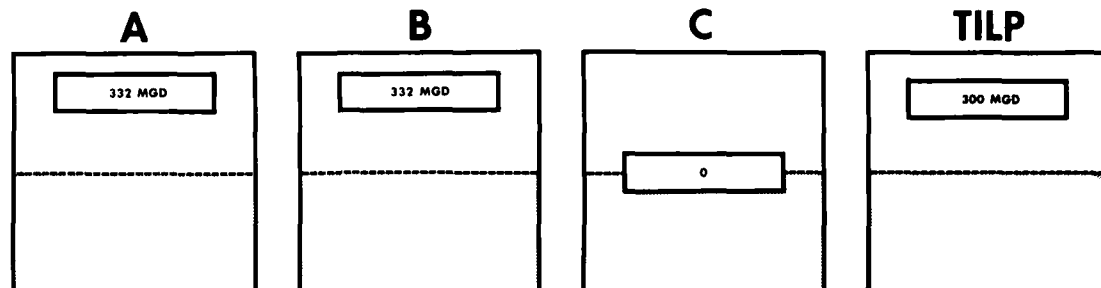
Recreation

The demand for recreation substantially exceeds the capacities provided for by either the Tocks Project or any of the alternative programs discussed. The annual visitations shown on the accompanying exhibit range from 2 million per year in Program C, which is only the Delaware Water Gap National Recreation Area without the lake, to 4 million per year provided for under Phase 1 of the Tocks Project.

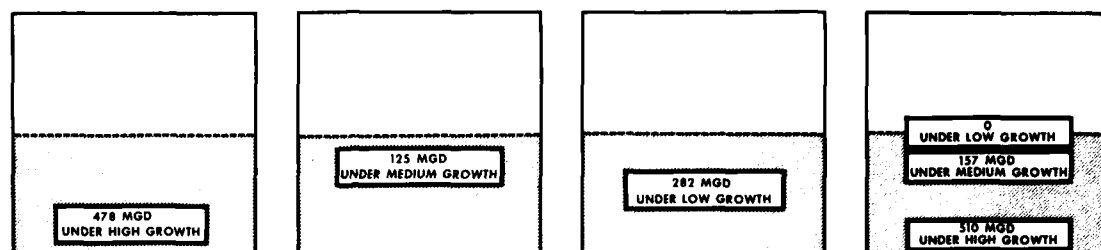
Electric Power

Since the demand for peaking power through the forecast period is greater than that which could be supplied by either the Tocks Project or comparable facilities, the output level of the Tocks Project of 1,300 MWe was considered to be appropriate for the alternative programs.

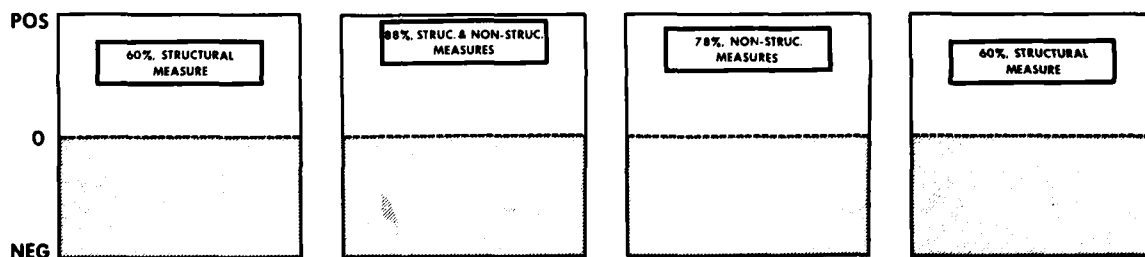
WATER SUPPLY PROVIDED
(NEW JERSEY SUBAREA)



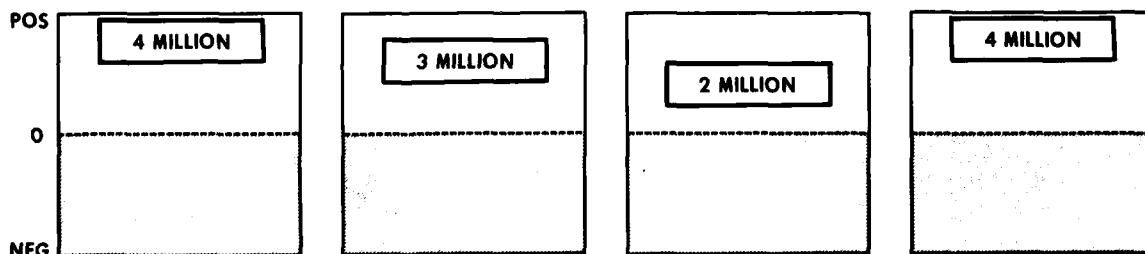
WATER SUPPLY REQUIRED FROM OTHER SOURCES
(NEW JERSEY SUBAREA)



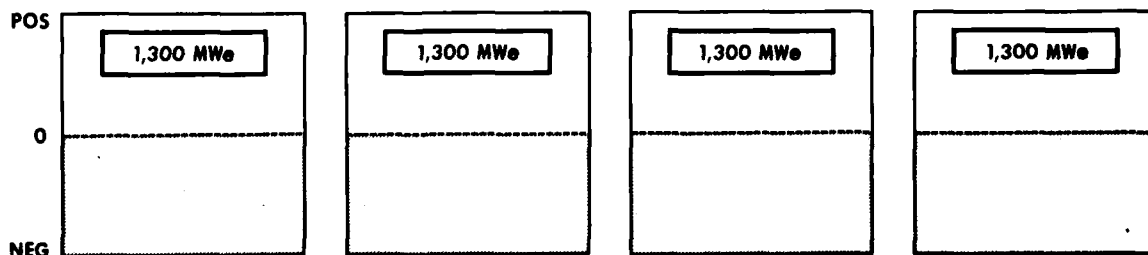
% OF FLOOD DAMAGEABLE PROPERTY PROTECTED



RECREATION VISITATION (PHASE I)



ELECTRIC POWER SUPPLIED



SUMMARY OF DIRECT COSTS AND BENEFITS

Costs and benefits associated with a project may be categorized in many ways. Those directly and completely attributable to the Tocks Project and alternatives to it are considered separately in this sub-section.

Many other very pertinent costs and benefits, both quantifiable and non-quantifiable, some of comparable or greater magnitude than the "direct" ones, are not included as part of the benefit-cost analysis but are reflected and presented in the other evaluation categories. Further, because of the assumptions and imprecisions inherent in the benefit-cost analyses, the factors developed serve primarily as an indication of relative economic efficiency between alternatives rather than as a measure of the feasibility of a single course of action. It is also to be emphasized that the benefit-cost analysis is but one of many components in the overall evaluation procedure and that it only indicates financial performance with respect to an established goal, not the adequacy of the goal itself.

Capital Costs

These represent the costs for facility construction, purchase of equipment, land acquisition and other types of initial expenses. The lesser output of Program C is reflected in its lower capital cost.

Annual Costs

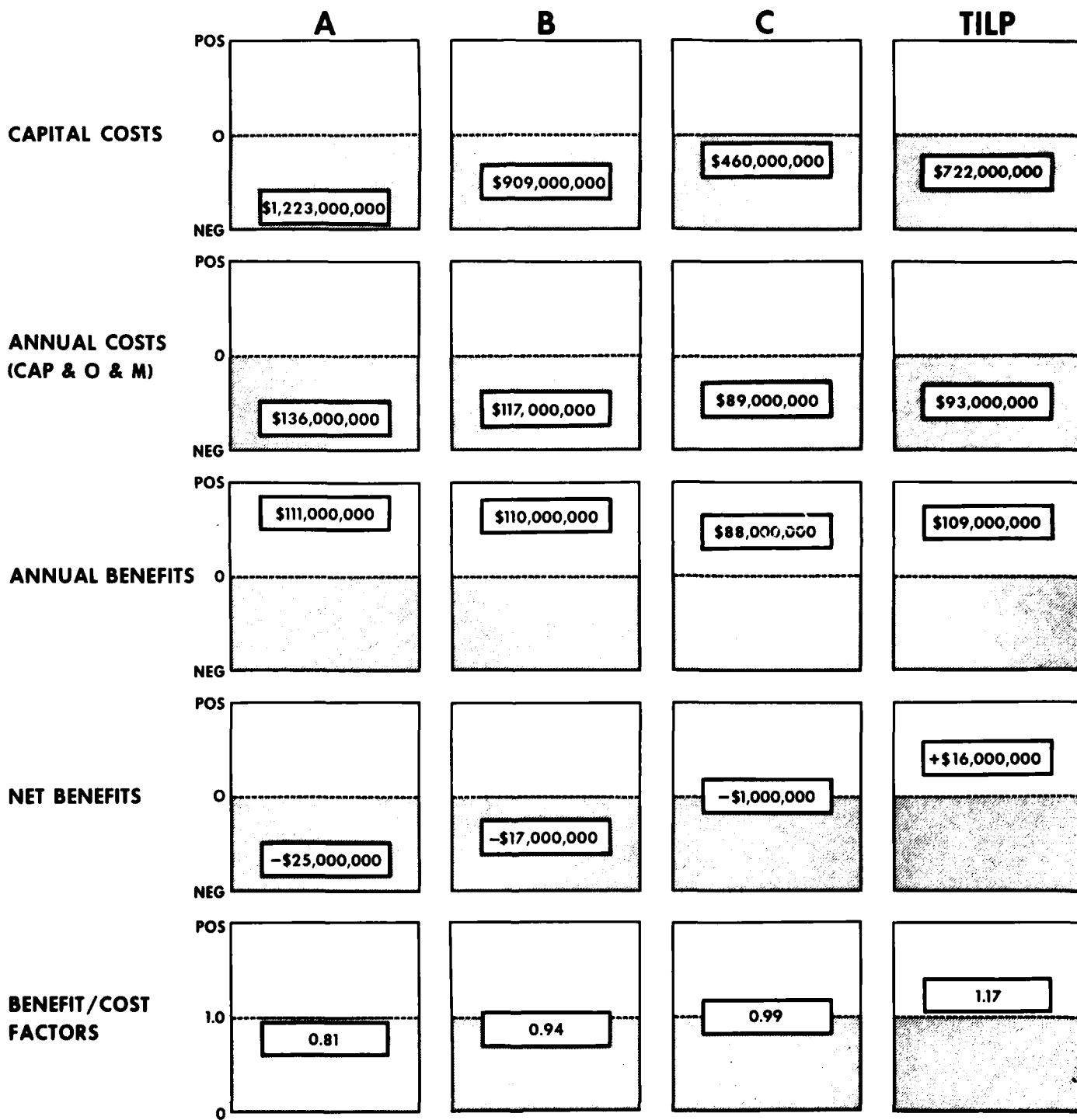
The annual costs shown are equivalent to the capital amounts noted above and operating and maintenance expenses estimated on an annual basis. The capital cost is translated into an equivalent annual amount utilizing, in this case, a 5% percent interest rate and economic lives of 100 years for water supply and flood control measures and 50 years for recreation and power generation facilities.

Annual Benefits

These measure the beneficial outputs of the various programs. Since the demand for water supply and electric power is relatively inelastic, the levels of projected prices or charges for these desired and needed outputs are considered to be roughly indicative of the relative or comparative benefits which could be realized. Where the water supply and the electric power outputs are the same, the estimated benefits are also similar.

Recreation benefits are most approximate as the true value of a recreational experience cannot be quantified. Flood control and protection benefits reflect damages prevented or for which compensation is provided. However, the lack of detailed survey data and uncertainties regarding the degree of future implementation of flood plain regulations make these also only order-of-magnitude estimates.

The magnitudes of both the costs and benefits of the Tocks Project and the alternative programs are substantially influenced by their electric power compo-



nents. Were these to be removed from the analyses, all the benefit/cost factors would be reduced with the benefit/cost factors for the alternative programs being reduced more than the TILP factor.

Net Benefits

Net benefits, or annual benefits less annual costs, are roughly comparable to profit in a private organization. It is typical of multi-purpose projects to perform favorably when evaluated on the basis of direct costs and benefits. Since the same cost of construction goes to serve more than one purpose, it is a more efficient use of capital for the benefits produced.

Benefit/Cost Factors

This is an approximate measure of the benefits produced for each unit of invested capital. It is thus roughly indicative of the degree of efficiency with which capital is used. Here again, the relative economic efficiency of the multi-purpose Tocks Project is reflected in its higher benefit/cost factor.

SUMMARY OF LAND USE GOALS

Effect on Community Cohesiveness

Major recreational facilities such as the National Recreation Area, with or without the lake, which serve regional rather than local recreational needs generally have a detrimental effect on community cohesiveness. The urban state parks included in Program A, however, can provide a focus for the immediate communities which they will serve.

Open Space Preservation

In addition to the recreational facilities' preservation of open space, the flood plain management and control programs in Alternatives B and C will have similar beneficial effects.

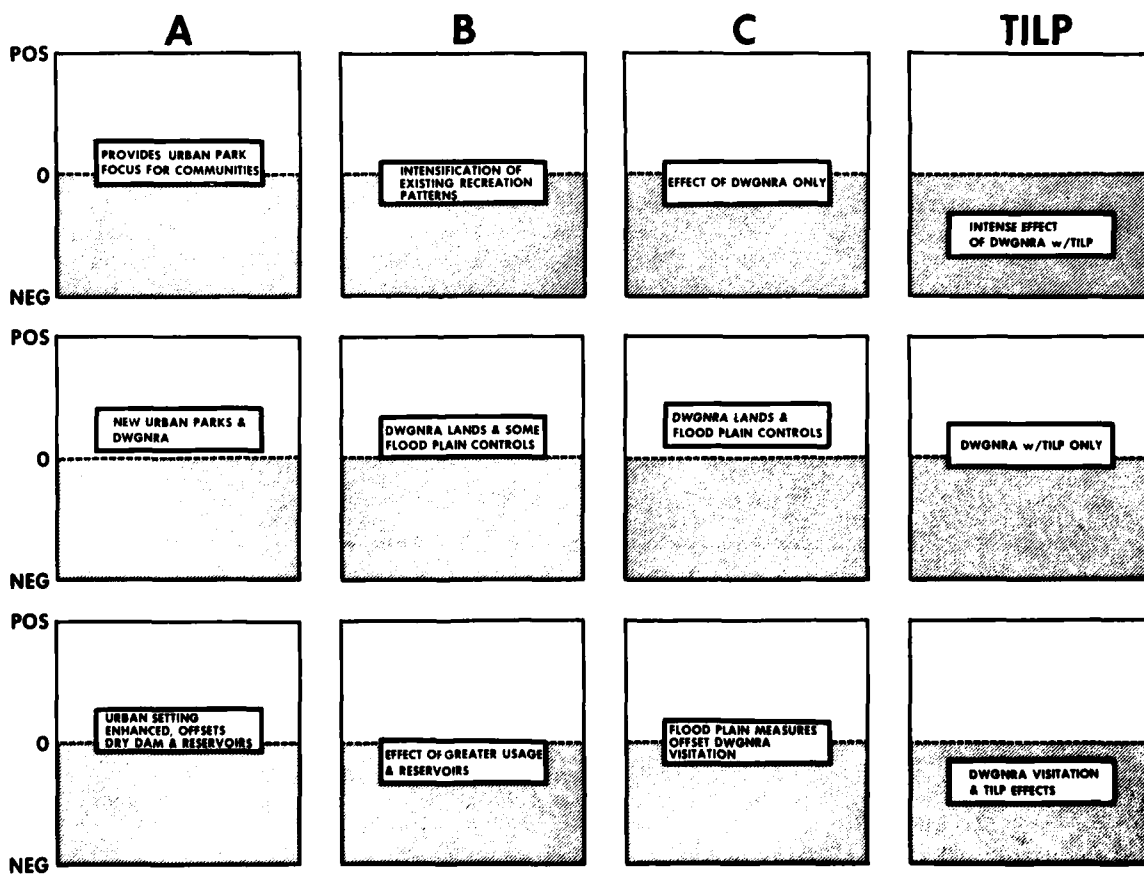
Existing Character and Aesthetic Preservation

In Program A, the urban setting of the state parks will offset some of the adverse impacts of the dry dam and reservoirs on the existing character of those areas. The flood plain management measures in Programs B and C will also tend to preserve the existing character of the flood plain areas.

**EFFECT ON
COMMUNITY
COHESIVENESS**

**OPEN - SPACE
PRESERVATION**

**EXISTING
CHARACTER &
AESTHETIC
PRESERVATION**



SUMMARY OF PRIMARY AND SECONDARY LOCAL ECONOMIC IMPACTS

Employment Stimulus

Primary categories of employment are short-term or construction employment; seasonal employment, primarily to serve recreational visitors; and long-term employment attributable to a basic expansion of the economy of the area. A major factor affecting employment is the degree of concentration of the new development or activity. Where it is concentrated in one or a small number of areas it is likely to be a greater stimulus than if the same activity were dispersed and existing businesses and employees absorbed a substantial portion of the new activity.

Residential Development Stimulus

Effects in this area may be attributable to second homes or year-round residential developments, the growth of the economic base, and new recreational opportunities. In rural or suburban areas where land is more available, the impact is likely to be greater. As with virtually all the evaluation criteria in this category, it is the recreation components of the various alternatives which will produce most of the secondary economic impacts.

Commercial Activity Stimulus

Primary factors here are the amount of recreation visitation anticipated and its degree of concentration. Where new commercial activity comprises a significant share of that already occurring, the effect of the new income and activity is somewhat greater than where it is a small portion of an area's economic base.

Initial Effect on Tax Base

The extent and severity of this impact is determined primarily by the amount of land taken off the tax rolls for recreation or other types of public facilities.

Long-Term Effects on Tax Revenues

Factors contributing to a positive effect on the tax base include the increased residential development anticipated which will increase the value of land in many areas. This can, however, affect some present land holders by increasing their taxes. Since a gain from increased land values could not be realized until their property is sold, hardships could result in some cases. Increased commercial activity will also increase the value of commercial property, which in turn will be reflected in increased tax revenues.

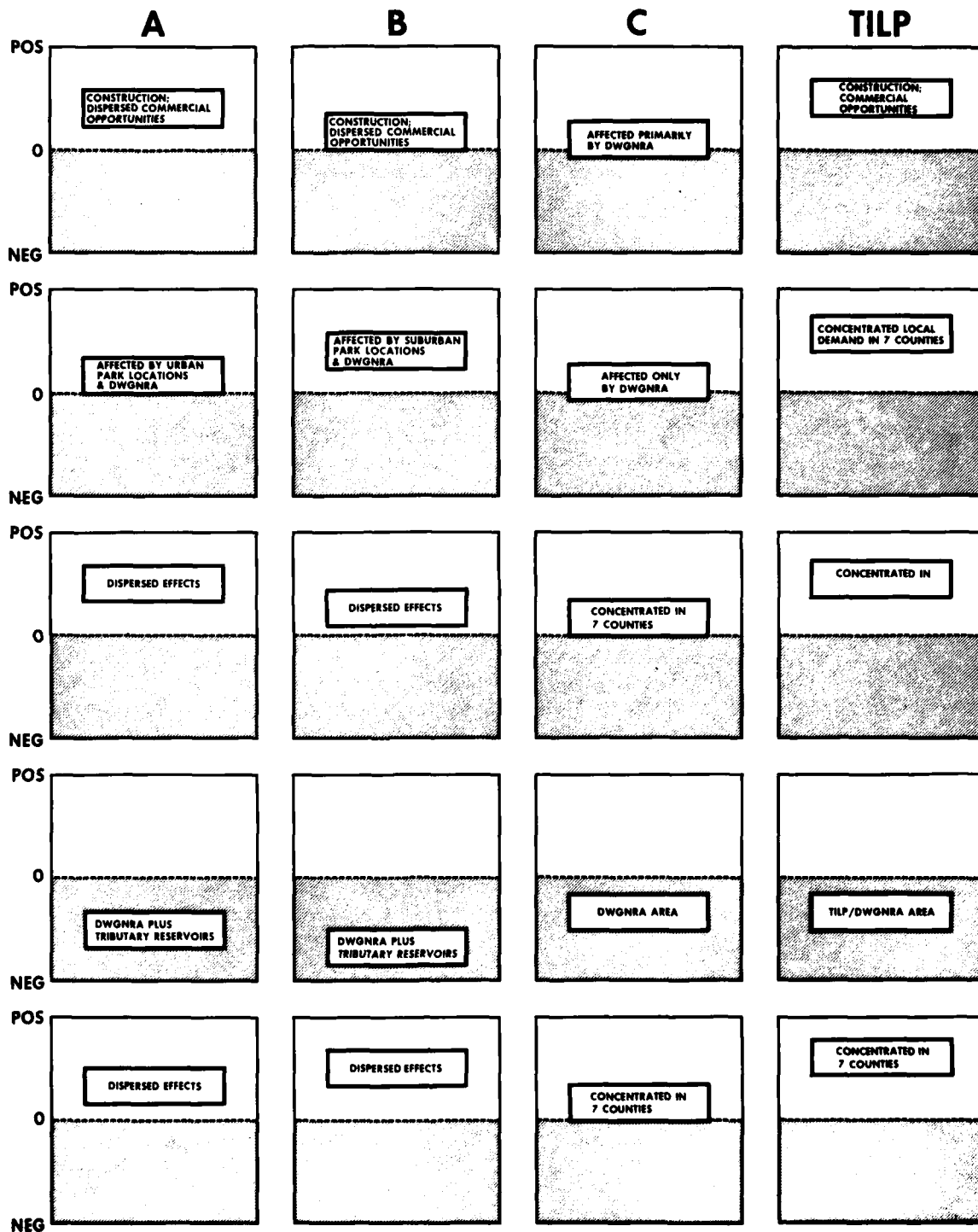
**EMPLOYMENT
STIMULUS**

**RESIDENTIAL
DEVELOPMENT
STIMULUS**

**COMMERCIAL
ACTIVITY
STIMULUS**

**INITIAL EFFECT
ON TAX BASE**

**LONG TERM
EFFECTS ON
TAX REVENUES**



SUMMARY OF LOCAL ENVIRONMENTAL IMPACTS

Water Quality

Factors in this evaluation include the adverse effects of impoundments and adjacent recreational usage on eutrophication and other aspects of water quality. Due to the effects of upstream development and the larger size of the Tocks Island Lake, the water quality effects could be more severe than with lesser impoundments on tributaries, such as in Programs A and B.

The proposed Tocks Lake will be eutrophic. However, water supply, flood control and power generation purposes will not be significantly affected by this condition. Eutrophication, to the degree predicted, will have a detrimental effect upon the use of portions of the lake for recreation purposes as some swimmers and boaters will find it relatively uninviting. Patronage levels are not expected to be affected by this condition.

Eutrophication of the proposed Tocks Lake results from point and non-point source pollution. Capital costs of sewage treatment facilities to control the former are estimated at \$2 to \$4 million, depending upon the degree of phosphorus removal required. The control of non-point sources, particularly poultry, cattle feedlot and dairy farm runoff, is estimated to have an order of magnitude capital cost of from 1/2 to 3/4 million dollars. The implementation of these control measures, which will probably be required eventually in any case, will be beneficial but eutrophic conditions will still exist in the Tocks Lake.

Air Quality and Noise Levels

Pertinent considerations affecting this evaluation criterion are construction activities and recreation traffic. The impacts in this category appear to be the least significant of the environmental considerations outlined.

Wildlife and Fish

The major factors affecting the ranking of the various programs are the type and extent of habitat lost due to construction and impoundment and the amount of habitat affected due to recreational or other activities. Included in this is the adverse effects of a main stem reservoir on shad movements and population. While the tributary impoundments in Program A do extend over a substantial area, it is only with the Tocks Project that large expanses of fish and wildlife habitat in a single location are lost.

Vegetation

The types and extent of plant communities to be lost or modified during construction and operation of the alternative programs or the Tocks Project determine the relative degrees of adverse impacts to be anticipated. The Tocks Project would impact the most extensive areas of vegetation, but Program B would adversely affect the most undisturbed and botanically interesting plant communities.

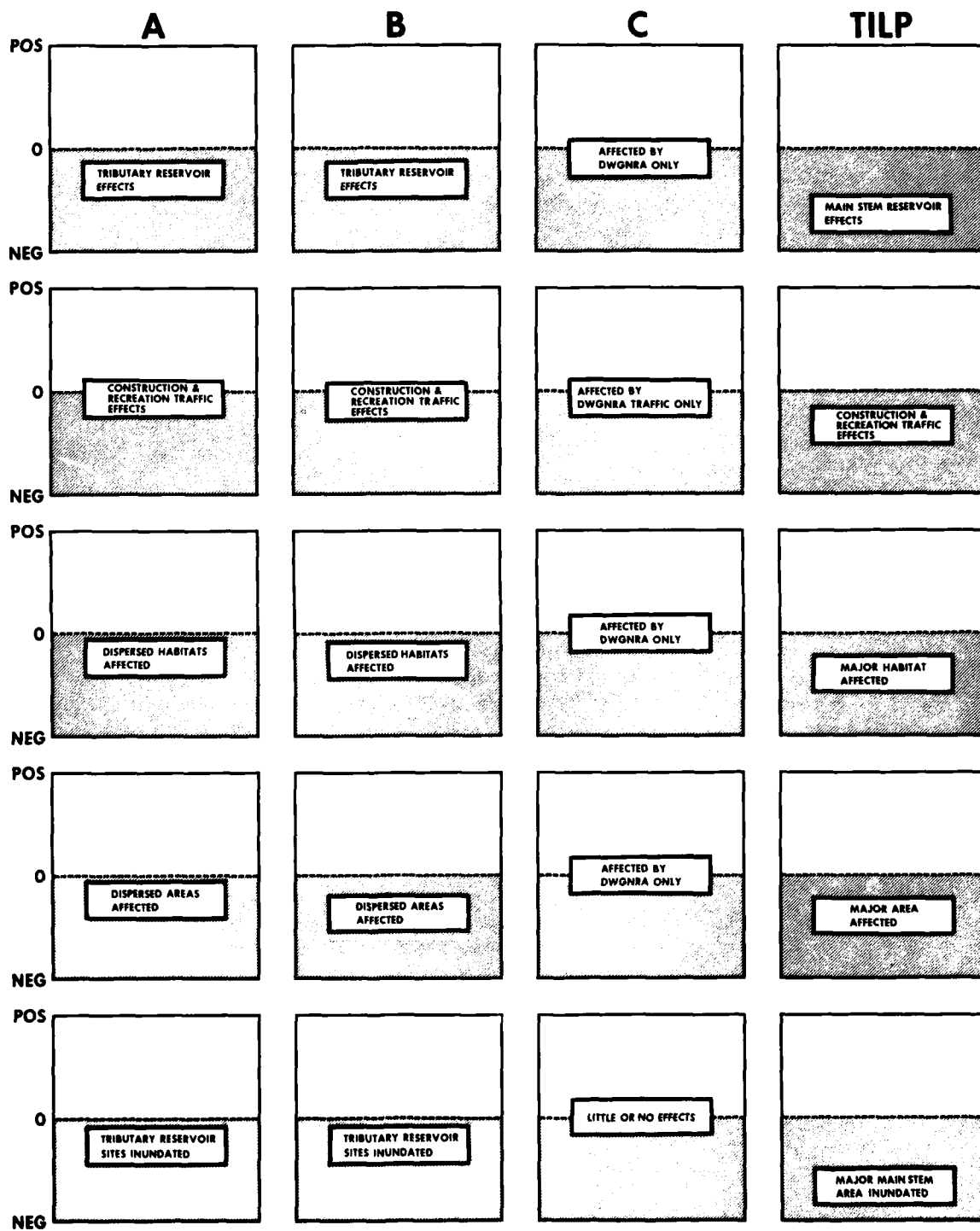
WATER QUALITY

AIR QUALITY & NOISE LEVELS

WILDLIFE & FISH

VEGETATION

ARCHEOLOGY & HISTORIC SITES



Archaeology and Historic Sites

A major concern is the loss of valuable main stem river valley sites through inundation. The substantial area inundated under the Tocks Lake is, therefore, a major adverse effect. The tributary reservoirs will have similar adverse effects on archaeology in their respective locations, but to a lesser degree, as the individual sites comprise smaller portions of the possible tributary areas of interest. The evaluations do not include the educational benefits of preserved sites in the alternative programs.

SUMMARY OF PUBLIC INFRASTRUCTURE IMPACTS

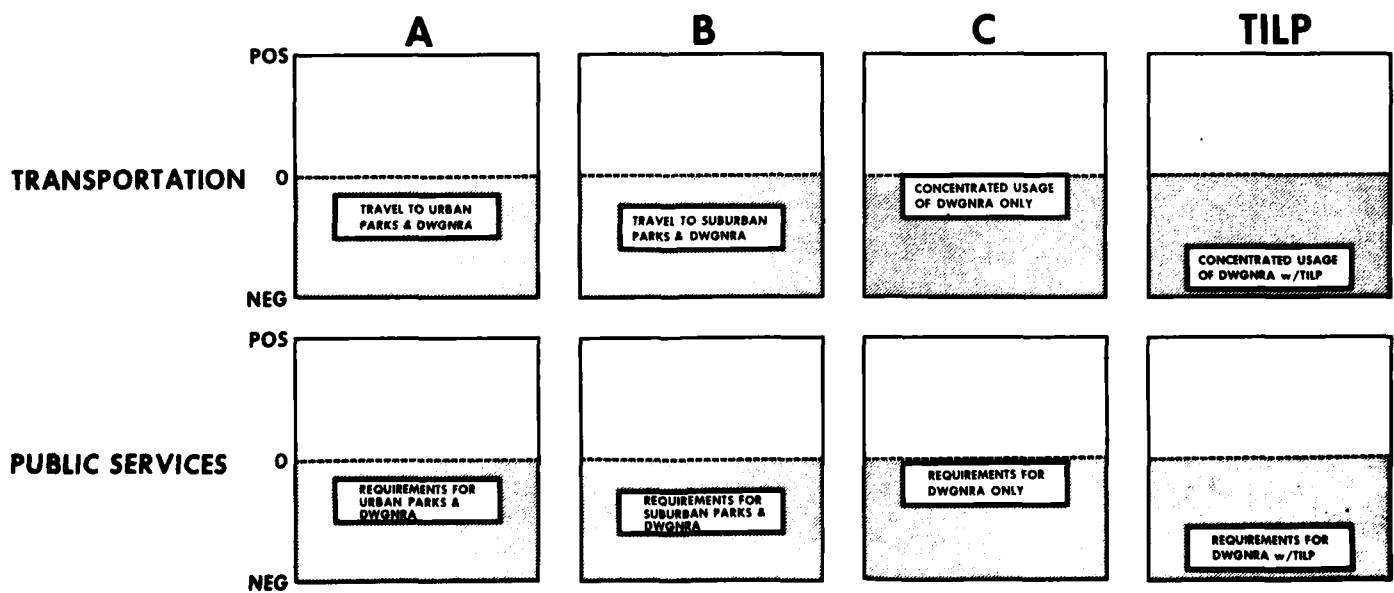
Transportation

The major factors influencing transportation impacts are the volume of travel generated and the distribution of this travel. The former is related to recreation visitation levels and the latter is related to the number and concentration of recreational facilities or destinations. The concentrated usage and high patronage of DWGNRA with the lake (under Phase I) thus gives it a relatively low ranking. Under Programs A and B additional patronage is destined to dispersed locations, though overall travel is increased over that associated with just DWGNRA without the lake, or Program C.

While Phase I transportation impacts are significant, transportation demands and facility requirements attributable to the normal growth and development of the region will also be quite substantial. If the transportation improvements needed to accommodate expected base or normal travel increases are not provided, the resulting adverse impacts will be greater than TILP-related transportation effects.

Public Services

Local governmental services such as police and emergency health care are required largely to take care of seasonal, short-term and transient recreational visitation. In urban or established areas where a substantial amount of development already exists, the additional load on public services due to new recreational facilities may not be as great as if the same load were superimposed upon the public service infrastructure of a lesser developed area.



SUMMARY OF LOCAL SOCIAL AND INSTITUTIONAL IMPACTS

Effect on Current Life Styles

The DWGNRA as well as other parks will have a generally adverse effect on local life styles due to the influx of visitors. The DWGNRA impact will be accentuated if it is combined with the Tocks Island Lake. Under Program B, the additional dispersed parks in suburban or rural settings will have comparable detrimental impacts on the life styles of their localities. With respect to Program A, however, the urban locations of the state parks may have beneficial effects on the life styles of those localities.

Institutional Constraints

A variety of governmental and other institutional actions will be required to implement all components of the contemplated projects. This will be particularly true of the non-structural flood control measures included in Programs B and C. Approval and authorization for reservoir and park construction appear to be less involved.

Public Acceptance

The Tocks Island Lake Project is, of course, a controversial project. There will also be some public acceptance problems with respect to certain non-structural flood control measures, and DWGNRA by itself and the suburban parks may encounter public acceptance difficulties. Under Program A, the evident urban benefits will offset the foregoing detrimental factors of that program with regard to the state parks.

Funding

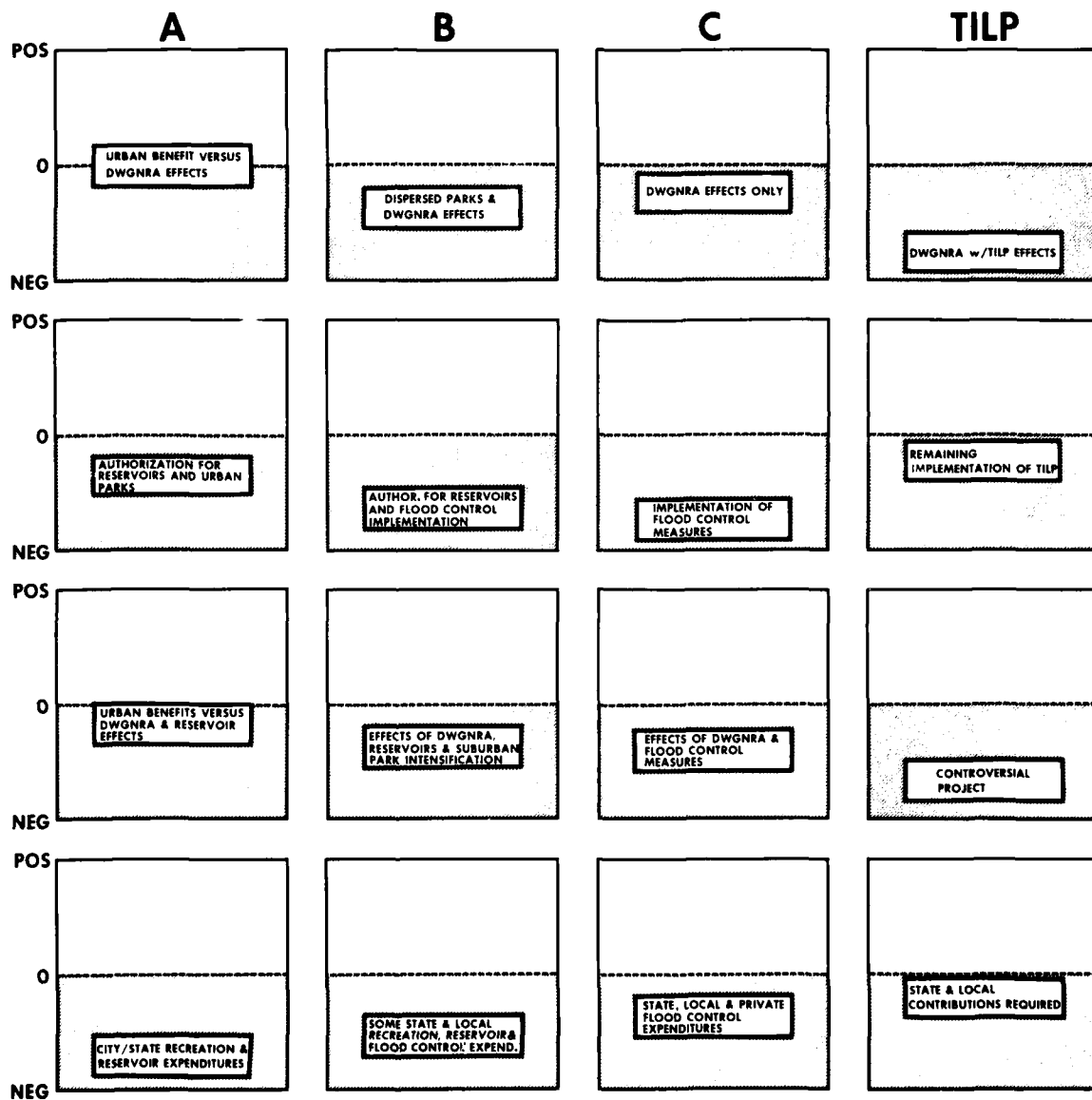
Program A will require local and state expenditures for recreational facilities and reservoirs. Under Program B, some state and local expenditures will be required for recreation, the reservoirs, and flood control measures. Under Program C, private expenditures for some non-structural flood control measures will also be required. The Tocks Project, exclusive of the private power facilities, would be Federally financed with water user charges levied after a period of years to cover the water supply component of the project cost.

**EFFECT
ON CURRENT
LIFE-STYLES**

**INSTITUTIONAL
CONSTRAINTS**

**PUBLIC
ACCEPTANCE**

FUNDING



Other Considerations

REVIEW OF THE TOCKS ISLAND PROJECT

The Tocks Island Lake Project was formulated as part of a comprehensive plan to meet water resource needs in the Delaware River Basin and contiguous areas. The assumptions regarding need and design conditions in the initial planning are considered to be adequate to satisfy the authorized project purposes. Preliminary planning was performed in accordance with governing procedures and regulations at that time, except that the use of alternative non-structural flood control measures was only investigated to a limited extent.

Drawdown conditions due to the Project will have a detrimental effect on recreational use of the lake in late summer—August and September—and will also decrease the attractiveness of the lake at some other times.

INSTITUTIONAL ASPECTS

While the Supreme Court has shown repeatedly its preference for the resolution of interstate water disputes by voluntary compact, in the 1931 and 1954 Delaware River cases the Court fixed specific diversion and compensating release requirements on the states. It did leave the door open for the parties to return to the Court if changed circumstances warranted it.

The adoption of the Delaware River Basin Compact in 1961 effectively froze the provisions of the 1954 Court Decree for 100 years, since the parties explicitly waived their rights to go back to the Court, except in extremely limited circumstances. The Delaware River Basin Commission, under the compact, has authority to alter diversions and releases of the Decree, but only by unanimous consent of the four States involved and the City of New York in the absence of an emergency, and by unanimous consent of the four States and the United States in the case of an emergency.

The Supreme Court Decree and the Delaware River Basin Compact will continue to govern the disposition of the Basin's water resources. Changes in the Basin's water regime and other water resource planning, proposals, and actions must therefore be consistent with the provisions of the Compact and Decree.

Only the Congress has the power to deauthorize the project. If it does so, it is to be expected that it will explicitly address such questions as future use and/or disposition of project lands, including lands required for the Delaware Water Gap National Recreation Area. It is most likely that provisions will be made for the continuance of DWGNRA.

Explicit project deferral by Congress would leave the lands under the Corps of Engineers and/or Park Service for control and management. Congress would provide funds for minimal maintenance. Should deferral occur, costs already expended would have to be carried forward over the deferral period. Any investment made in river edge recreation facilities would be lost when impoundment occurred. Recreation benefits attributable to a future project with a lake could also be reduced by the extended use of the interim park without a lake. Deferred benefits from the other authorized project purposes (water supply, flood control, and electric power) would increase during the deferral period, but probably at a rate somewhat less than escalating project costs. Extended project deferral is also detrimental to sound planning by all private and public interests, including governmental units, local businesses and land developers.

INFORMATION REQUIREMENTS

The findings and evaluations contained in this study are based upon the type, extent and detail of the available data and information noted throughout the report. While this extensive data base is sufficient for present study purposes, for longer term planning there are three particular areas in which additional information clearly must be obtained or developed. These relate to future industrial water sources, primarily in Northern New Jersey; the need for an implementable master plan for the development of New Jersey water resources; and the practicality and efficacy of non-structural flood protection measures in the Delaware River flood plain.

Only a small portion of the industrial water presently consumed in Northern New Jersey is provided by public systems. As overall industrial water usage is so great, a relatively limited percent increase in the publicly supplied water provided industry could impose a significant burden on public water supplies. It is thus essential that the possible yield, location and rough costs of potential industrial water sources be ascertained on a comprehensive regional basis. This would permit accurate projections to be made of the publicly supplied industrial water component of overall future public water supply needs.

With respect to water resources master planning for New Jersey, many projects, including the Tocks Project, have been proposed over the years to meet projected needs. It is now most essential that the full evaluation of these projects and decisions required for acceptable master planning and implementable programs be made. As water consumption and projections of unsatisfied demand are increasing, these decisions should not be further postponed.

Federal and New Jersey flood plain management legislation has been passed and is in the process of being implemented. A bill on this subject is pending in Pennsylvania. The ultimate usefulness of the non-structural flood protection measures addressed by this legislation is dependent upon cooperation by municipal officials and agencies; costs to be borne by private parties and local and state governments; general public acceptance of the approach, costs, and specific conditions embodied in the legislation; and the physical conditions—structural types, land uses, topography—actually prevailing in the flood plain. Specific information to determine the effects and interactions of these and related factors on the overall efficacy of non-structural flood protection measures should be developed as soon as possible.

REGIONAL IMPACTS

The proposed Tocks Island Lake Project and the alternative programs outlined will produce a range of impacts on both the immediate area and the region. These impacts, while the focus of much of this report, are not the most significant or severe anticipated for the study area in the coming years.

There is little doubt that with the continued absence of comprehensive land use controls in portions of the region, a return to normal economic conditions together with the nearly completed interstate highway system will have a substantially greater adverse effect than will either the proposed Tocks Island Lake Project or alternatives to it.

There is no basis whatsoever for assuming that existing types and intensities of land use and life styles will continue to characterize the Delaware River Basin area and that sound planning and land use controls, particularly on the local level, can be deferred. The adverse impacts outlined as stemming from the specific developments discussed will be realized many times over if the necessary planning and control regulations are not fully carried out. To minimize adverse impacts due both to basic regional development changes which are bound to occur and to the lesser effects of the Tocks or alternatives to it, it is essential that comprehensive land use planning, controls, and regulations be implemented.

There will continue to be substantial community needs associated with projected regional growth. However, the additional impacts caused by the Tocks Project or alternatives to it will place additional burdens upon the public services, resources and general fabric of nearby municipalities which will be beyond their capabilities to accommodate or manage. It thus will be absolutely essential that substantial amounts of "impact" funds and appropriate programs and planning assistance be provided from state and/or Federal sources to permit advantage to be taken of both this aid and existing programs. This assistance would be required in order to increase the capacity of various public services and mitigate undesirable effects resulting from proximity to a regional facility.

Consultants

Subconsultants utilized for portions of the overall study effort are listed below. The areas in which each provided study inputs are also noted.

Major Subconsultant firms:

- Hammer, Siler, George Associates—Regional and Development Economics, Recreation Analyses.
- URS/Forrest & Cotton, Inc.—Flood Control Studies and Civil Engineering.
- URS Energy Services Company—Electric Power.
- URS Research Company—Environmental Studies.

Other Subconsultants:

- Mr. Edward Weinberg of Duncan, Brown, Weinberg & Palmer—Legal Appraisals.
- Intasa—Water Supply Projections.
- Ide Associates, Inc.—Recreation Forecasting and Analyses.
- Prof. Myron B. Fiering, Harvard University—Water Resources.
- Mr. William D. Giezantanner, Harvard University—Recreation Planning.
- Dr. Joseph Shapiro, University of Minnesota—Limnology.
- Stephen S. Sussna & Associates—Land Use Planning Policy.